PTV volume cm^3	Conformity Index			Heterogeneity Index		D25% cc			Gradient Index	
	HD	MMLC	Diff %	HD	MMLC	HD	MMLC	Diff %	HD	MMLC
2.20	1.38	1.44	4.46	0.18	0.18	53.30	67.70	21.27	6.14	7.27
4.10	1.30	1.33	2.05	0.21	0.22	102.98	117.77	12.56	5.64	6.34
10.10	1.22	1.25	2.96	0.18	0.18	241.20	266.80	9.59	5.20	5.55
16.30	1.19	1.21	1.75	0.21	0.22	346.32	374.68	7.57	4.68	5.02
24.70	1.16	1.17	1.39	0.23	0.24	488.50	526.50	7.22	4.38	4.66
39.30	1.14	1.14	0.00	0.27	0.26	690.98	722.64	4.38	4.02	4.17
57.10	1.11	1.11	0.01	0.24	0.24	954.97	1001.77	4.67	3.97	4.11
71.80	1.09	1.09	0.00	0.20	0.21	1111.70	1126.10	1.28	3.77	3.94
92.00	1.10	1.10	0.00	0.24	0.24	1333.96	1355.50	1.59	3.72	3.87
119.80	1.08	1.08	0.00	0.22	0.25	1604.90	1655.35	3.05	3.68	3.84
151.00	1.07	1.07	0.00	0.17	0.20	1893.40	1936.68	2.23	3.61	3.67

Conclusions: Data derived from this dosimetric study showed that both the MLC systems very well satisfy the RTOG 0915 guidelines in terms of CI as well as GI. In-depth analysis showed that there was a marginal benefit in terms of both CI as well as GI with HDMLC over MMLC in PTV volume less than 4cc. However clinical significance of this marginal benefit warrants further investigation in order to find out whether these small dosimetric advantages can narrate into clinical outcome. Further the institutions who has only 5mm MMLC can still do SBRT as the results showed that it can very well satisfy RTOG criteria and match HDMLC provided the volume of PTV is greater than 4cc.

PD-0598

Automated VMAT treatment planning for head and neck cancer

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Purpose/Objective: A method was developed to automate RT treatment planning for Head and Neck (H&N) cancer in order to reduce workload and create consistency in the RT treatment planning procedure.
Materials and Methods: For a group of 8 patients (2 oropharynx, 3 hypopharynx, 3 larynx), we developed scripts to generate treatment plans based on manual delineations of the organs at risk (OARs) and PTV. In this planning study we focus on VMAT treatment planning for H&N patients, where we consider the elective RT in a sequential treatment with a prescribed dose of 23 x 2Gy. For treatment planning the Pinnacle[3] treatment planning system was used, in combination with the native scripting language and Python. We generated 6MV dual arc (178-182°) VMAT treatment plans, using the Pinnacle[3] SmartArc optimization module. The automated method consists of a first optimization round using objectives solely on the PTV (Min and Max Dose), whole body, brainstem and spinal cord (Max Dose). In a second optimization round the objectives for the remaining OARs are introduced: base of tongue, constructor muscle, larynx, oral cavity and parotid glands. In 5 successive optimization rounds the mean dose objectives for these OARs were systematically lowered, by setting an objective to reduce the mean dose to the OARs by 1 Gy compared to the achieved dose for the latest optimization round, *if* the score of the penalty function was *below* 10^{-6}. For a fair comparison, all treatment plans were automatically prescribed to a PTV coverage of V95%=99%. The automatically generated treatment plans (ATPs) were evaluated on the dose levels in the OARs, and compared with the manually generated clinical treatment plans (CTPs).
Results: For 6 out of 8 ATPs, the clinical constraints on the OARs (D_{max} Brainstem, D_{mean} Base of Tongue, etc … see table) and volume of the PTV receiving a high dose (V107%<1%) were met for all ATPs, if they were met for the corresponding CTP. In the remaining 2 plans the volume of the PTV receiving a high dose was considered unacceptable (V107%>>1%) and these plans were not further analyzed. The differences in the clinical parameters between the accepted ATP and CTP were not significant. These treatment plans are therefore considered adequate. This technique can be applied to generate a good starting point for clinical treatment plans. However, it remains essential that generated ATPs are carefully evaluated by an experienced dosimetrist, and that the RT plan is adapted when necessary.

	ATP-CTP(sd), Gy)
Dmax Brainstem	-0.4 (2.1)
Dmean Base of Tongue	-0.9 (1.3)
Dmean Constructor muscle	0.1 (0.8)
Dmean Larynx	0.3 (0.8)
Dmean Oral cavity	-1.5 (3.6)
Dmean contralateral parotid gland	-0.6 (1.2)
Dmean ipsilateral parotid gland	1.4 (2.2)
D1% Spinal cord	-0.5 (1.7)

Table: Average difference in dose levels for OARs in the H&N region between the clinical treatment plan (CTP) and automatic treatment plan (ATP). The value in parentheses indicates the standard deviation.

Conclusions: Using an automated method for generating VMAT treatment plans for H&N cancer, we were able to generate adequate treatment plans for 6 out of the 8 considered patients.

PD-0599

Evaluation of the trade-offs for coplanar and non-coplanar treatment techniques for lung SBRT

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Purpose/Objective: Lung SBRT has emerged as a promising technique to treat early stage lung cancer patients with medically inoperable disease and for patients who refuse surgery when using biologically effective doses in excess of 100 Gy_{10}. The delivery techniques that have been proposed vary in terms of ability to meet treatment planning criteria, delivery accuracy and estimated treatment times. The purpose of this study is to evaluate coplanar VMAT (C-VMAT), non-coplanar VMAT (NC-VMAT) and non-coplanar IMRT (NC-IMRT) in terms of ability to meet planning criteria, dosimetric accuracy of delivery and beam-on time.
Materials and Methods: There were 18 cases that were identified as patients who would have been eligible to enrol on our in-house SBRT protocol. Each case had 3 unique treatment plans created: C-VMAT, NC-VMAT and NC-IMRT. C-VMAT plans consisted of 2 coplanar 360 degree arcs. NC-VMAT consisted of a single coplanar 360 degree arc and a 90 degree non-coplanar arc created for a couch rotation of 90 degrees. NC-IMRT consisted of 7 equally spaced co-planar beams and 4 beams delivered for a couch rotation of 90 degrees. Treatment plans were planned with Pinnacle v9 (Philips Medical Systems, Andover, MA, USA) and attempted to meet planning goals set out with our in-house protocol which was adapted from the British Columbia provincial lung SBRT guidelines. All plans were delivered to the ArcCheck device (Sun Nuclear Corporation, Melbourne, FL, USA) where both delivery accuracy and beam-on time was evaluated.
Results: Treatment planning criteria can be sub-divided into PTV criteria and OAR criteria. For the PTV criteria, all plans were able to meet the prescription criteria and high dose spillage criteria however the low dose spillage criteria (i.e. ratio of 50% isovolume to PTV) had minor deviations for 11/18 C-VMAT plans and 3/18 for both NC-VMAT and NC-IMRT plans. For OARs, all plans performed equally well for sparing OARs and the inability to meet planning criteria was largely due to OAR overlap with the PTV which occurred for ribs in 12/18 cases, for heart in 3/18 cases and for the great vessels in 2/18 cases. The mean lung dose, V20, V10, V5 and V2 were very similar across all delivery techniques. The ArcCheck delivery accuracy as evaluated by gamma(2%,2 mm) for all 18 cases was 92.6±3.7%for C-VMAT, 96.6±2.1% for NC-VMAT and 95.1±2.1% for NC-IMRT. The treatment times were ~5.0 minutes for C-VMAT, ~7.0 minutes for NC-VMAT and ~12.5 minutes for NC-IMRT.
Conclusions: All three treatment techniques were deemed to be clinically acceptable by two lung radiation oncologists in terms of plan quality, delivery accuracy and treatment times. The main trade-offs identified in this study were that C-VMAT produced plans with shorter beam-on times while sacrificing conformity for the low dose spillage volume.

PD-0600

A geometrical analysis focused on the beam-on time reduction in helical tomotherapy-based SBRT for lung tumors.

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